NAVAL SURFACE WARFARE CENTER
DAHLGREN DIVISION

ELECTROMAGNETIC & SENSOR SYSTEMS DEPARTMENT

DoD Spectrum Workshop 2009

AESOP Program Status Briefing

AESOP
Afloat Electromagnetic Spectrum Operations Program

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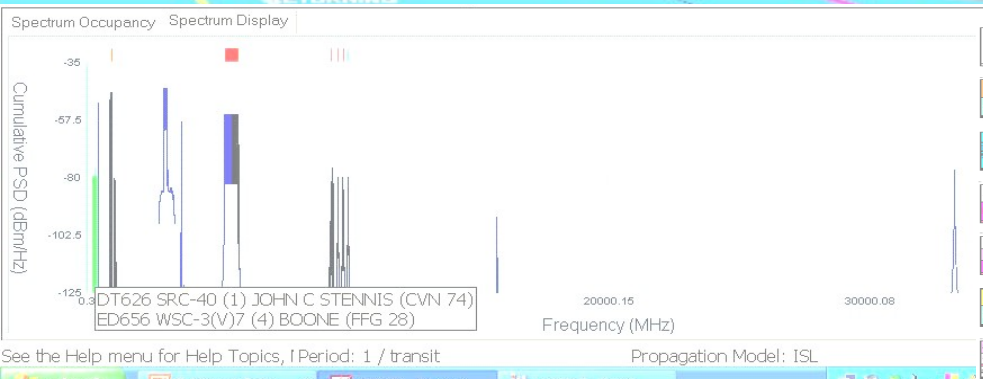
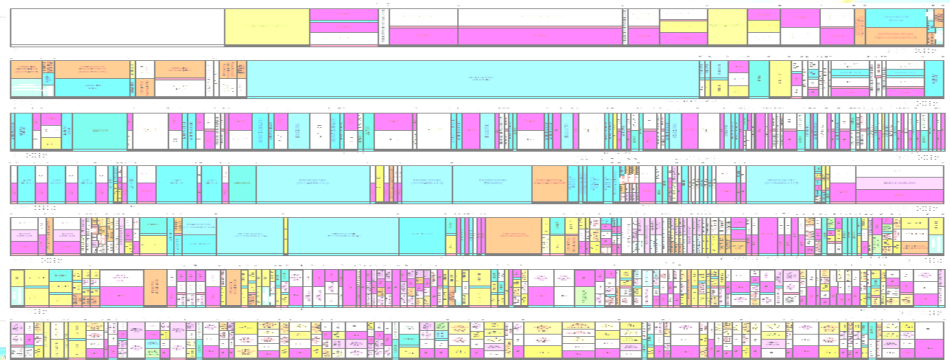
Agenda

EMAC
ELECTROMAGNETIC MISSION ASSURANCE CENTER

ELECTROMAGNETIC & SENSOR SYSTEMS DEPARTMENT

- AESOP Overview
- Data Management
  - Integrity
  - Interoperability
- Business Processes





Afloat Electromagnetic Spectrum Operations Program (AESOP)

AESOP is the US Navy software tool for Strike Group Radar and Communications Planning for coordinating spectrum interoperability in operations worldwide.

- **AESOP uses previously "allocated" frequencies to generate optimal Radar Plans and OPTASK COMMs that**

  - **Accommodate mission-specific spectrum and bandwidth requirements**
  - **Adhere to laws, host nation agreements, and chain-of-command emission policies**

- **AESOP integrates and de-conflicts the spectrum requirements of all acquired systems in the global operational electromagnetic environment (EME):**

  - **Radars - Navigation Aids**
  - **Communication Systems - Electronic Warfare Systems**
  - **Civilian Systems - Allied Systems**
  - **Commercial Off-the-Shelf Systems (COTS)**

Afloat Electromagnetic Spectrum Operations Program (AESOP)

- AESOP is in use (>30 years) by warfighters in theater worldwide to calculate, identify, and mitigate electromagnetic interference (EMI) between radars, navigation aids, communication systems, and electronic warfare systems.
- AESOP uses built-in, generic Radio Frequency and Electromagnetic Interference (EMI) prediction tools.
- AESOP provides spectrum visualization that translates analysis results into meaningful operational and actionable information.
- AESOP's Assignment Executive uses numerical optimization techniques that can be applied to in-theatre force's spectrum use.
- AESOP supports changes to the force structure, disposition of assets, and operational environment.
- AESOP produces appropriate output (Messages & Reports) to describe results.

Data Management: Data Integrity

- AESOP database undergoes extensive periodic reviews and refreshes to stay current with
  - Commissioning and De-commissioning of Platforms
  - Equipment Inventory Upgrades
  - Equipment Parametric Data
  - Updated Host Nation Agreements, Laws, Treaties
- Database integrity is maintained through review of
  - Program Office Installation Records
  - In-Service Engineering Agents' Information
  - Feedback from platforms [e.g., AESOP "Reply" messages and Communication Equipment Population Survey (CEPS) messages]
  - Shipboard Electromagnetic Compatibility Improvement Program (SEMCIP) Ship EMI Certification Records
  - Face-to-Face Meetings

Data Management: Host Nation Agreements

- AESOP Spectrum Restrictions and Communication Standing Plans incorporate frequency restrictions and usage documented in National Telecommunication and Information Administration (NTIA), JSC Area Studies, and Host Nation Agreements.
- Communication Standing Plans are populated with frequencies coordinated with host countries.
- Radar Frequency Plans adhere to numbered fleet Emission Policies and port visit guidance that govern frequency usage within host countries' areas of control.
- AESOP users have the ability to add, delete, and modify frequency usage to comply with host nation agreements as they occur.

Data Management: DD-1494 Measurements

- Measurements for development of DD-1494s
- Ensures data integrity and accuracy

Data Management: MCEB Pub 8 Compliance

- AESOP 2.1 (fielded 2008) implemented XML import and export capability of messages.
- Registration of AESOP 2.1 XML schema in DoD metadata registry has been completed.
- AESOP (next version) will be updated to use the MCEB Pub 8, *Spectrum Management Allied Data Exchange Format (SMADEF)* XML schema, while maintaining legacy compatibility with MCEB Pub 7, *Frequency Resource Record System (FRRS) Standard Frequency Action Format (SFAF),* as needed.

Business Processes

AREA FREQUENCY COORDINATOR

Joint Task Force/ Joint Spectrum Management Element

Fleet Commander, Joint Frequency Management Office

Spectrum Planner

AESOP Office

SHORE UNITS

Strike Group Staff

PARTICIPATING UNITS

Business Process: Joint Warfare Support

- AESOP supports radar and communication analysis and spectrum planning for joint warfare operations.
  - Platforms - ships, submarines, aircraft, military and civilian ground sites
  - Equipment – radars, combat systems, electronic warfare, NAVAIDS, shipboard and manpack radios
  - Communication nets – COCOM and joint nets in addition to USN circuits
  - Ability to create new platforms, equipment and nets to support joint warfare spectrum planning worldwide

Business Process: Joint Task Force Operations

Next version of AESOP:

- During Joint Task Force (JTF) operations, AESOP spectrum planners will be able to publish the Navy's input to the Joint Restricted Frequencies List (JRFL).
- Once a JRFL has been developed for an exercise or operation, AESOP will be able to import the overall, approved JRFL to monitor possible Navy impact to JRFL systems.
- AESOP will include the ability to designate systems, nets, and local area frequency assignments as part of the JRFL. Frequencies on the Worldwide Restricted Frequency Listing will be included in the software (addressed in current AESOP 2.1 radar & comm plans).
- JRFL data exchanges will comply with MCEB Pub 8 and legacy compatibility with MCEB Pub 7 will be supported.

Business Process: Coalition Operations

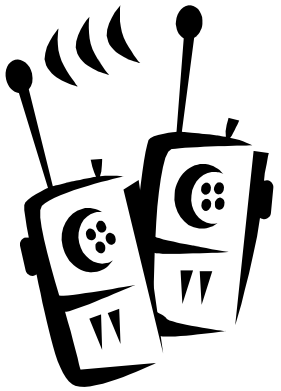
- AESOP supports development of radar and communication plans for US and coalition forces.
- In addition to the ships of the US Navy, AESOP contains the fleets of over 60 countries.
- Platforms' equipment inventory is included and populated with parametric data.
- AESOP-generated Communication Plans are compatible with APP-11 (allied) format.
- AESOP models are generalized to accommodate analysis for US and coalition equipment.
- NATO version NEOP-2007 was fielded in 2008.

Business Process: Electronic Warfare (EW)

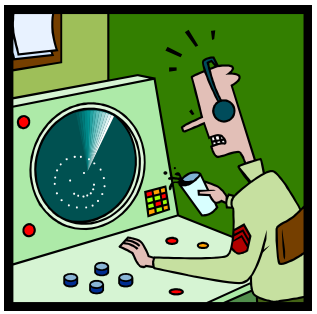
- In order to analyze net connectivity and EMI from/to communications systems that are guarding nets, operational loadset frequencies used by tactical communications system (e.g., frequency hoppers) are imported into AESOP, associated with net(s), and then analyzed for possible EMI.
- This analysis improves the performance of communications networks in the presence of Counter Radio-controlled IED Electronic Warfare (CREW) and other EW systems, as it identifies EMI within the loadset and other frequencies.
- AESOP 2.1 database contains communication systems, CREW systems, and shipboard EW systems, expandable to all other systems.
- AESOP is used to determine distances at which jammers will impact systems

Business Process: EMI Analysis

- AESOP's Radiowave Propagation Modeling techniques analyze the interactions between radars, EW, navigation aids, and communication systems and provide predicted levels of EMI.
- Types of analysis include:
  - Inter-platform EMI Analysis
  - Intra-platform (co-site) EMI Analysis
  - Ship-to-shore (civilian & military) EMI Analysis
  - Net Connectivity Analysis



Business Process: EMI Analysis



- Radar and Comm Analysis Tools
  - Radar Coverage Plots
  - Intermodulation Interference Analysis
  - Satellite Availability & Blockages
  - High Frequency Skywave Analysis
  - Spectrum Occupancy View/Spectrum Analyzer Display
- Environmental Data (for use in EMI prediction)
  - Digital Terrain Elevation Data (DTED)
  - Meteorological Data

Business Process: Net-Centric Application

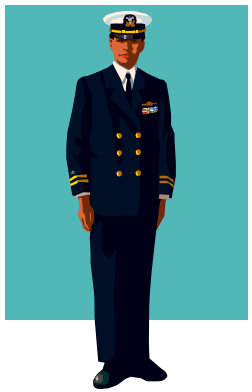
Next version of AESOP:

- To comply with ForceNet initiatives, AESOP moving to a net-centric framework.
- AESOP will be configured as a web-enabled, thick-client application. AESOP will have a remotely-located database, which will provide for collaboration. A master AESOP database will be deployed on a shore-based server accessible via SIPRNET.
- AESOP's stand-alone capability, using a local SQLServer Express database, must be retained to support users without access to SIPRNET or with limited bandwidth.

Business Process: Impact Assessments

- AESOP is an engineering tool as well as a spectrum planning tool.
- AESOP can be configured to analyze the impact on systems when part of the spectrum is targeted for auction.
- Impact assessments on systems include
  - Impact of spectrum crowding
  - Impact of increased stand-off distances
  - Impact of reduced spectrum on supportability of OPTASK COMM plans
  - Limitation on number of deployable units in an AOR to maintain compatibility

Business Process: Spectrum Planning Courses



- AESOP Spectrum Planning and Joint Coordination Process training is included in the following courses:
  - Aegis Training and Readiness Center (ATRC), Dahlgren VA: various officer & enlisted pipeline courses
  - Center for Information Dominance (CID), Norfolk VA, Corry Station, Pensacola FL, and San Diego CA:
    - Information and Communications Managers Course (ICMC)
    - Information Professions/Information Warfare (IP/IW) Basic course
  - Navy Information Operations Center (NIOC), Norfolk VA and San Diego CA: Strike Group Pre-Deployment Workshops
  - Interservice Radio Frequency Management School (IRFMS), Keesler AFB: Electromagnetic Spectrum Management Course (ESMC)
  - US Army Signal Center, Fort Gordon GA:
    - Basic Spectrum Manager (BSM) course
    - Joint Spectrum Manager (JSM) course

Summary

- AESOP's currently fielded capabilities accommodate spectrum coordination and planning for worldwide operation of military systems

Questions/Discussion

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